OPUS System
Introduction

by

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TITLE:

OPUS System: AN INTRODUCTION

PURPOSE:

Overview of PSS and OPUS

INFORMATION IMPARTED:

- **Goals of a PSS**

- **Who we are and how we fit in with respect to industry**

- **The problem domain**

- **How the human fits in**

- **OPUS architecture**

THE McMASTER GROUP

- ## Lead Investigators

    - Bill Garland
        Nuclear Engineer
        Process Background

    - Skip Poehlman
        Computer Systems
        Data Acquisition

- ## Researchers:

    - Asghar Bokhari
        Electrical Engineering
        Computer Systems

    - Bob Wilson
        Mechanical Engineer
        Consultant and Project Management

    - Charles Baetsen
        Engineering Physics
        Graduate Research Student

    - Paolo DeTina
        Computer Systems and Engineering
        Graduate Research Student

    - Rob Leger
        Chemical Engineering and Engineering Physics
        Graduate Research Student

OUR GOAL

- A Vehicle for Technology Transfer

- We offer a platform to deliver real-time information management products

- Assemble ideas and techniques

OPUS   Operator - User Performance Support

FUNDING

- In 1991 we were awarded a NSERC STRATEGIC GRANT for 3 years.

- It is project oriented with a defined deliverable as opposed to the more typical open-ended research grant.

- Funding will end this fall.

- One of the deliverables is a workshop for technology transfer purposes.
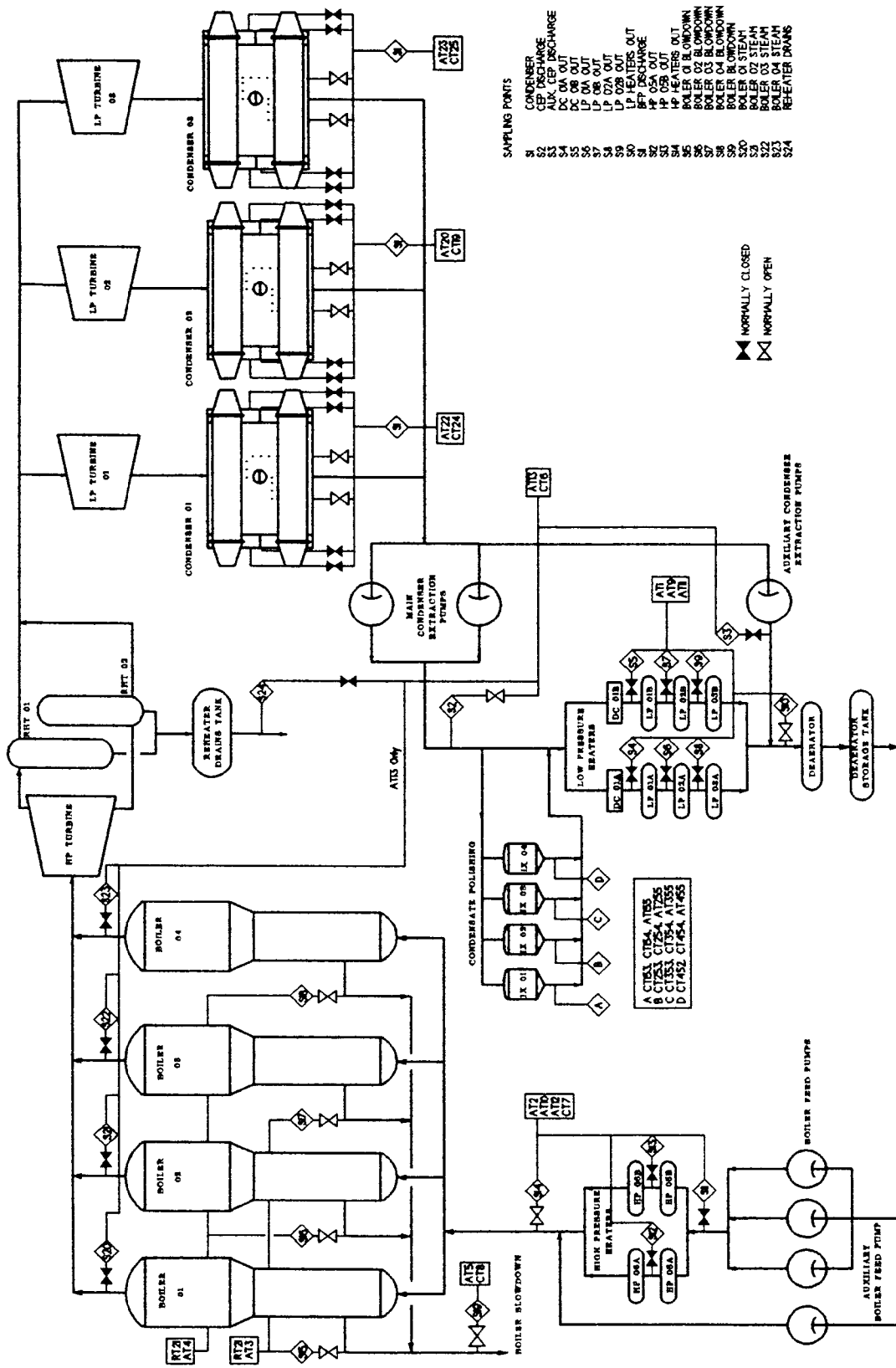
  ☞ That's what we are doing now. ☜

- What you are about to see is a prototype that we hope will be tested at Pt. Lepreau Generating Station in New Brunswick starting this summer.

THE GOALS OF A
PERFORMANCE SUPPORT SYSTEM

- To provide control aid in times of human overload

- To help with the mundane, freeing up the user for more complex tasks

- To achieve technology insertion along the lines of an extended calculator

THE ROLE OF THE UNIVERSITY

- **Pre-competitive**
  NOT in competition with industry or consultants
  results are public domain

- **Three to five year time frame**
  industry usually has a shorter time frame

- **Concept generation**
  universities have a more trans-industry flavour
  Distil genericism

- **Scoping platform**
  cheaper
  software discounts
  salaries and overhead lower
  not bound by existing practise

- **Training role**
  Best technology transfer is on two feet.

OPUS System
Operator-User Performance Support

SAMPLING POINTS

S1	CONDENSER
S2	CEP DISCHARGE
S3	AUX. CEP DISCHARGE
S4	DC 0A OUT
S5	DC 0B OUT
S6	LP 0A OUT
S7	LP 0B OUT
S4	LP 02A OUT
S0	LP 02B OUT
S1	LP HEATERS OUT
S2	BFP DISCHARGE
S3	HP 05A OUT
S4	HP 05B OUT
S5	HP HEATERS OUT
S6	BOILER 02 BLOWDOWN
S7	BOILER 03 BLOWDOWN
S8	BOILER 04 BLOWDOWN
S9	BOILER BLOWDOWN
S20	BOILER 01 STEAM
S3	BOILER 02 STEAM
S22	BOILER 03 STEAM
S23	BOILER 04 STEAM
S24	REHEATER DRAINS

NORMALLY CLOSED

NORMALLY OPEN

THE PROBLEM DOMAIN

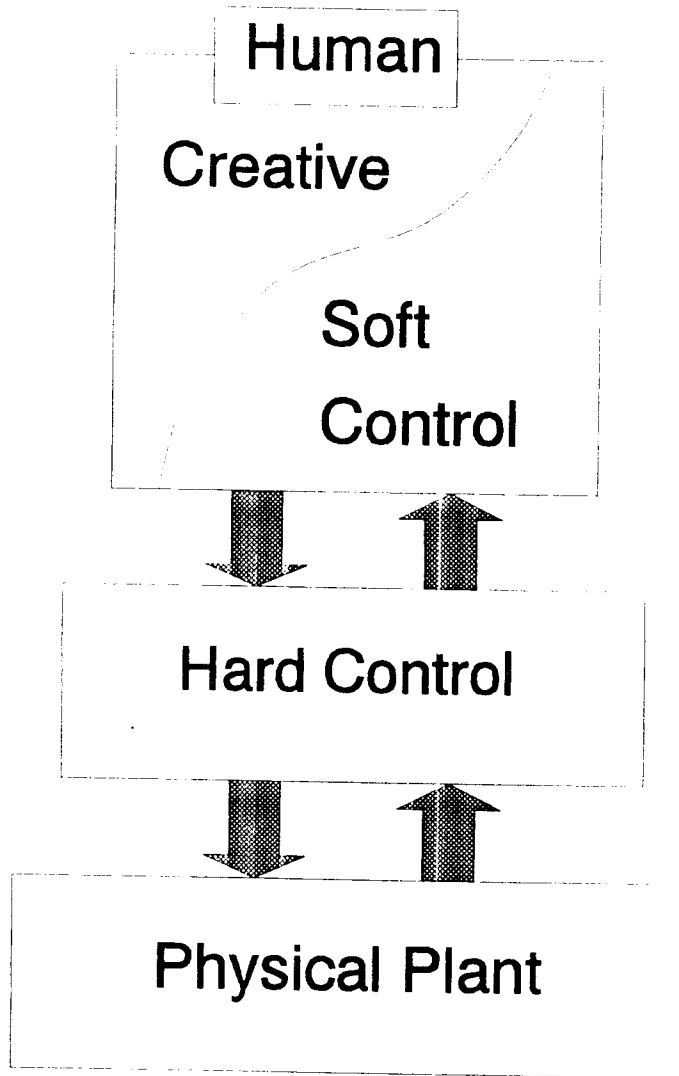- **Complex plants**

- **Data rich, info poor**

    stage 1: one sensor - one indicator

    stage 2: attribute based displays

    stage 3:operational aids ☞ **WE ARE HERE.**

- **The plant is ENGINEERED**

    plant is functionally and physically distributed

    decomposition based on

    function (functional abstraction)

    response time requirements

    information hiding (temporal abstraction)

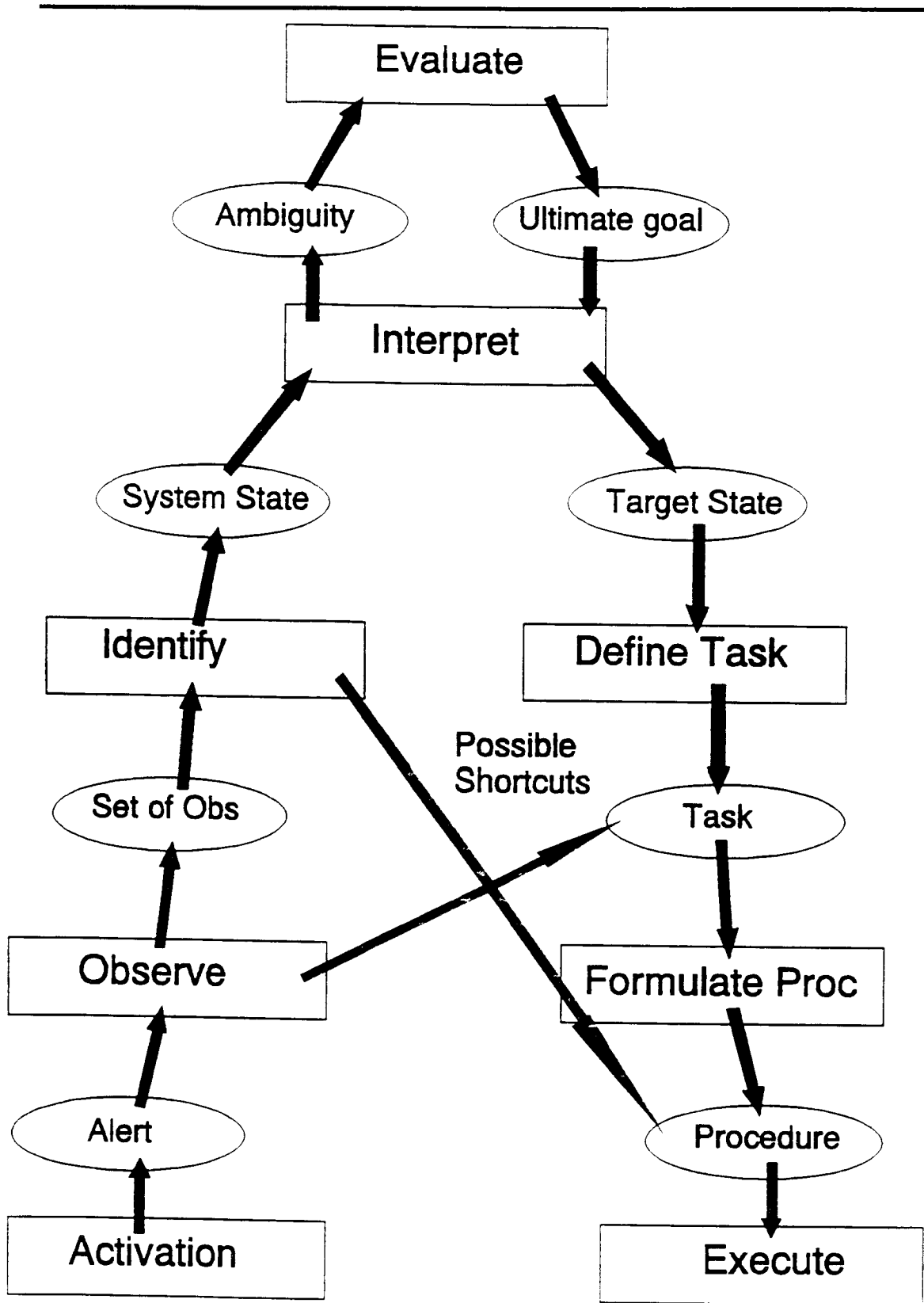- **Real-time (human needs, not data frequency)**

THE PROBLEM DOMAIN (cont'd)

- Plant operations are diverse

    maintenance and calibration

    monitoring and planning

    control and safety

- Plant operations are multifaceted

    disparate data bases

    multidisciplinary

- Events can happen anywhere, anytime

    asynchronous

- Procedural - by definition

    pre-enumerated

    operators need help in diagnosis

MACHINE VS HUMAN CENTRED

- Past work has been machine-centred

- Human-centred approach

- The paradigm shift is profound

- Bernard notes that the machine-centred approach is now considered inappropriate.

- Machine centred + wrong mental model
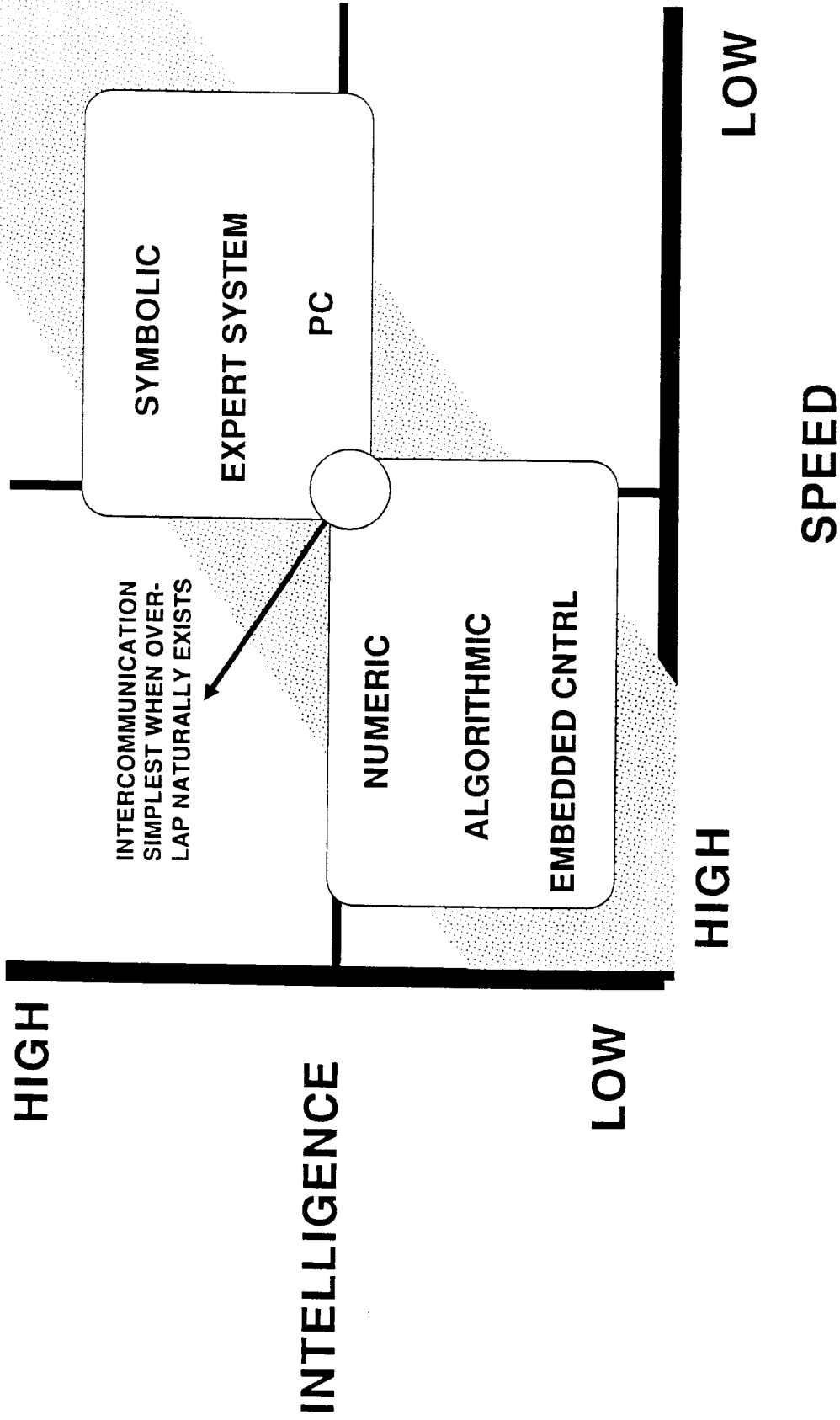 not accepted by operator
  leads to failure

Human

Creative

Soft

Control

Hard Control

Physical Plant

OPUS System
Operator-User Performance Support

IMPLEMENTATION SPACE

INTELLIGENCE

HIGH

LOW

SPEED

HIGH

LOW

SYMBOLIC

EXPERT SYSTEM

PC

NUMERIC

ALGORITHMIC

EMBEDDED CNTRL

INTERCOMMUNICATION SIMPLEST WHEN OVER-LAP NATURALLY EXISTS

INTELLIGENCE

HIGH

INTERCOMMUNICATION
COMPLEX WHEN OVER-
LAP MUST BE BRIDGED
BY COMMUNICATIONS
MECHANISM

INTELLIGENT AGENTS

INFORMATION
EXCHANGE

LOW

REAL-TIME
AGENTS

HIGH   SPEED   LOW
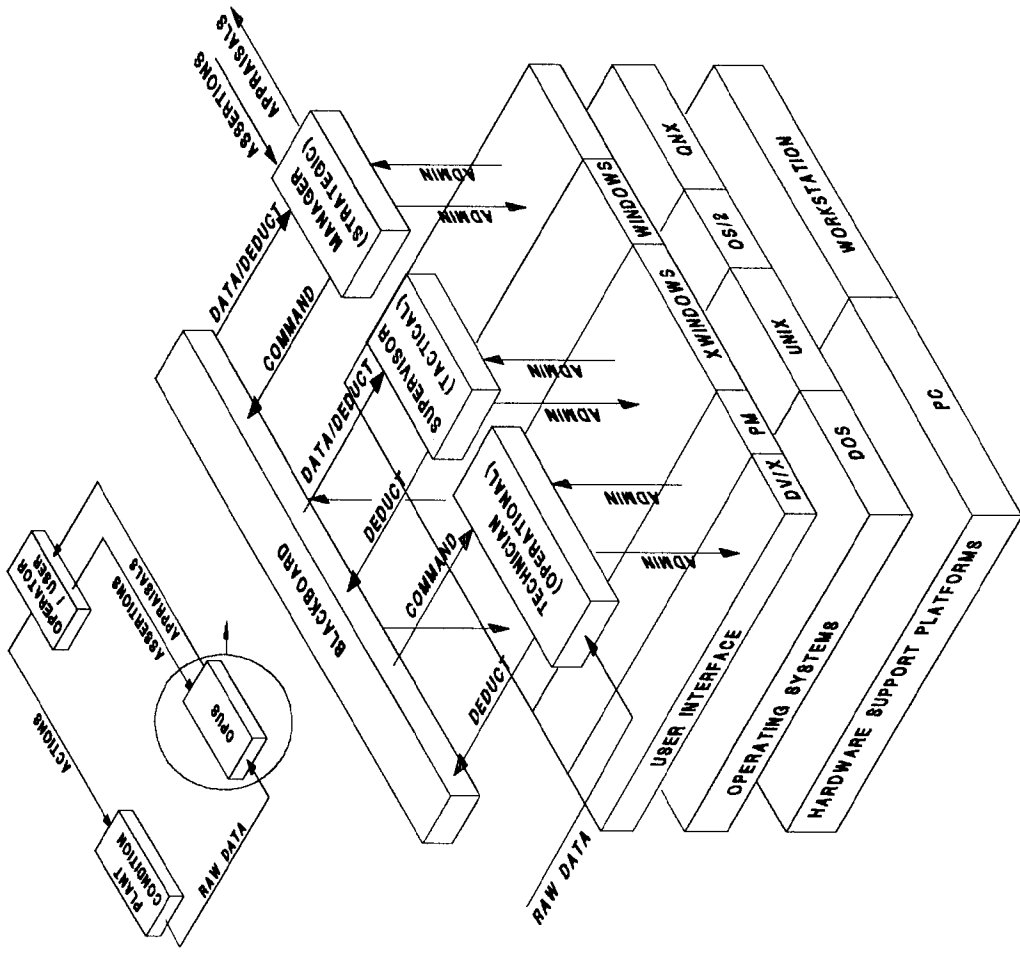
OPUS System
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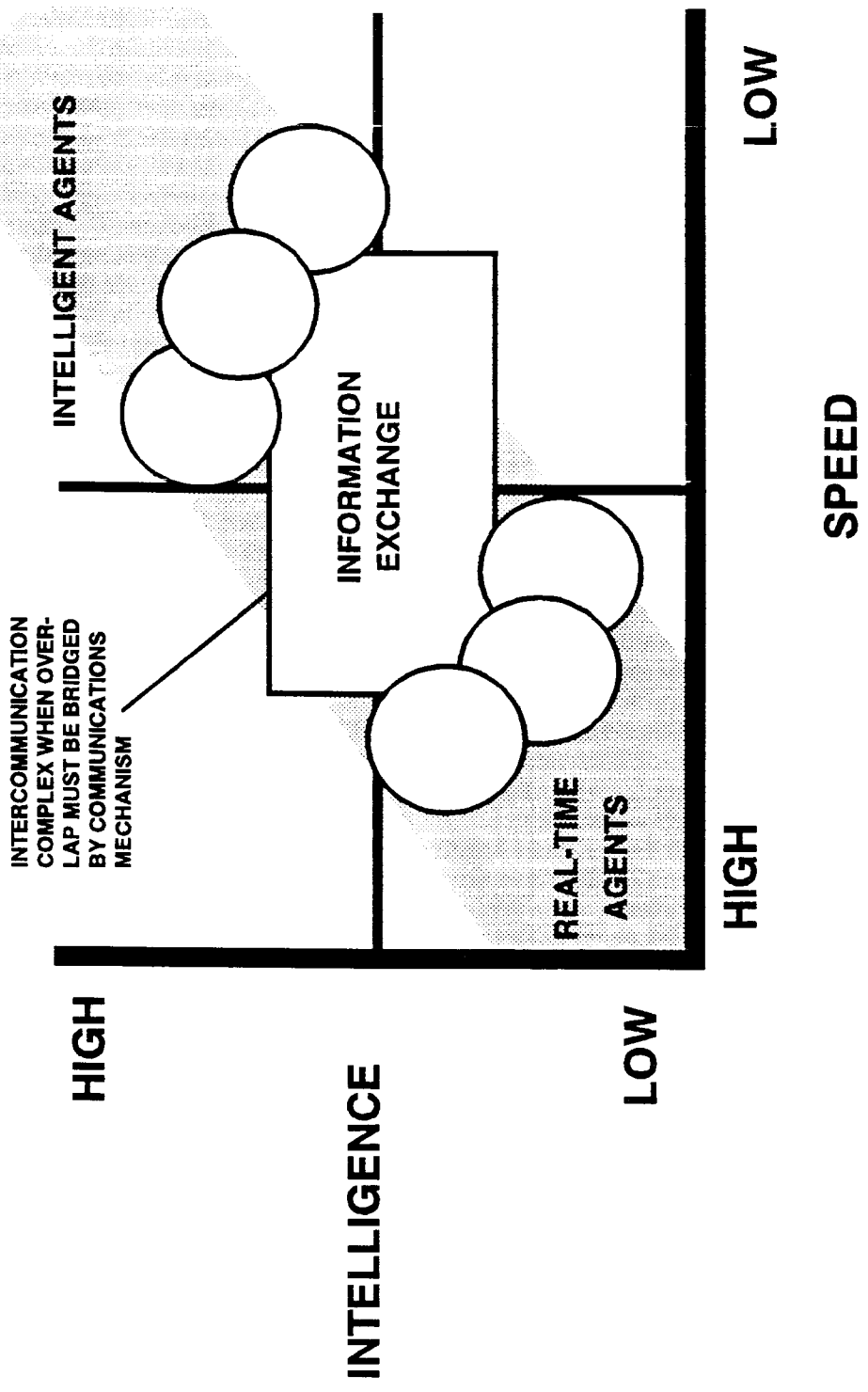
OPUS PHILOSOPHY

- **Anthropomorphic**

- **Functional decomposition (based on domain knowledge)**

    piecewise refinement

    low level numerics vs high level symbolics

- **Temporal decomposition**

    high speed numerics vs low speed symbolics

- **Alarm based**

    time history not required

- **Trend based**

    time history needed

OPUS System
Operator/User Performance Support System